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Adaptive reuse of heritage buildings; a systematic literature review of success factors



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ABSTRACT

Whilst adaptive reuse is often applied with good outcomes, we are also faced with projects that have not achieved the desired results. There is little insight into why some projects succeed and others fail, or even what constitutes "success" at all – due in part to the intangibility of the word "success" and unsettled definitions and synonyms of "adaptive reuse. Accordingly, this paper seeks to answer the question: What are the factors that can be used to assess the success of heritage adaptive reuse projects? This study is framed as a systematic literature review of relevant articles published or in press. The methodology is based on using a PRISMA diagram to address a number of papers that are screened in each step of the diagram: identification, screening, eligibility and included. The literature review process started with 731 in the first step and ends with the final results of 72 papers. The results are classified into ten categories of success factors: architectural, structural, socio-cultural, economic, environmental, energy, authenticity, legal, management and functional factors. Together, these provide a comprehensive understanding of factors that affect the success of adaptive reuse as a strategy to regenerate heritage buildings. This insight facilitates adaptive reuse strategies for designers, architects and real estate developers.

1. Introduction

A simple definition of adaptive reuse is "to re-use a building or structure for the purpose of giving it new life through a new function" (ODASA, 2014). Adaptive reuse is also defined by (Wilkinson, Remøy, & Langston, 2014) as a major change of a building with alterations of both the building itself and the function it accommodates. It is not only a process of building conversion by recycling useable components for the purpose of new use, but also a method and strategy that can be used to preserve its cultural heritage (Abdulameer & Sati'Abbas, 2020). Over the last two decades, studies and books such as "Building Adaptation" by Douglas (2006), "Adaptive Reuse of Built Heritage" by Plevoots and Cleempoel (2019), "Sustainable Building Adaptation" by Wilkinson et al. (2014) have focused on clarifying the process of adaptive reuse projects from the initial steps of research to the actual implementation of these projects. These studies aim to support stakeholders in developing

more adaptive reuse projects and to provide decision-support models such as the adaptSTAR model (Conejos, Langston, & Smith, 2013) and the ARP model (Langston, Wong, Hui, & Shen, 2008) to facilitate adaptive reuse projects. However, according to Dyson, Matthews, and Love (2016), "there has been limited work that has examined the factors that contribute to the success of adaptive reuse of heritage buildings". Although success factors are identified in some literature, a comprehensive categorisation or a systematic classification is lacking. Such a classification can not only contribute to better decision-making in practice but also lays the foundation for research into causal relationships.

Therefore this research seeks to answer the following question: **What are the factors that can be used to assess the success of heritage adaptive reuse projects?**

The definition of success in heritage adaptive reuse projects is critical to this study but describing what success means is challenging as it stems

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from different interpretations. According to [ICOMOS \(2010\)](#), a successful heritage adaptive reuse project modifies a place or building for a compatible use while retaining its cultural heritage value.

Usually, the international charters and conventions consider closely the integrity of historic buildings and their original value ([ICOMOS, 2000](#); [DEH, 2004](#); [NSW & RAIA, 2008](#)). For instance, the Australian Department of the Environment and Heritage defined the most successful heritage adaptive reuse projects are the ones that add a valuable contemporary layer for the future and more importantly respect and retain the building's heritage significance ([DEH, 2004](#)). [Shipley, Utz, and Parsons \(2006\)](#) determined successful adaptive reuse projects in respect of financial, regulatory, architectural and building type aspects. For the success of any adaptive reuse project undertaking research prior to its commencement is necessary ([Dyson et al., 2016](#)). The appreciation of successfully reused heritage buildings when they not only contribute to maintain the physical fabric of the heritage property but also serve to revitalize its built environment, is inevitable ([Hasnain & Mohseni, 2018](#)). Successful adaptive reuse projects possess good design for the building, good planning for the surrounding environment and also the community's concerns about the future of the heritage sites ([Macmillan, 2006](#)). [Plevoets and Van Clempoe \(2019\)](#) in their book "Adaptive reuse of the built heritage" claims that there is no single, accepted, well defined and acknowledged term that indicates the practice of changing existing buildings in a functional and architectural mode within the wide variety of scholarly studies. The work of [Wilkinson et al. \(2014\)](#), [Schmidt and Austin \(2016\)](#) and [Wong \(2016\)](#) confirm this controversy, ambiguity and uncertainty. Hence, there is no global answer to the success of adaptive reuse strategy.

Accurate classification of principles, factors and criteria that affect the success of any adaptive reuse project is not simply due to the intangibility of the word (success), a wide variety of interpretations from different points of view, a broad area of research and a mix of non-measurable and measurable parameters. Therefore, this paper applies a systematic literature review approach, which enables a comprehensive and systematic classification.

2. Methodology: systematic review & PRISMA

This research adopts a systematic literature review methodology to investigate, recognise and categorise the success factors of adaptive reuse projects. This study follows the 'Preferred Reporting Items for Systematic Reviews and Meta-Analyses' (PRISMA) guidelines to provide the logical basis for the review and pre-planned methodological and analytic approach, at an early stage ([Moher, Liberati, Tetzlaff, & Altman, 2009](#)).

The field of adaptive reuse studies unofficially commences with the book 'New Uses for Old Buildings' by [Cantacuzino \(1975\)](#), a pioneering researcher on adaptive reuse ([Plevoets & Van Clempoe, 2011](#)). Hence, this study includes articles published since 1975. The review is further limited to literature published before January 1, 2021.

The data search was done in the Scopus and Web of science databases. And the articles were selected from the subject areas of Engineering, Social Sciences, Arts and Humanities, Environmental Science, Energy, Computer Science, Material Science, Earth and Planetary Science, Business Management and Accounting and Physics and Astronomy. The selection of English articles encompassed the initial five subject areas, as the built environment and (heritage) buildings are subcategories of these fields, directly and indirectly.

An essential aspect of conducting a systematic literature review involves the meticulous identification and selection of appropriate keywords/terms to search for in databases. The area of research is defined as the adaptive reuse of built heritage and its synonyms. However, there is a wide variety of synonyms that are used to define adaptation practices. [Wilkinson et al. \(2014\)](#) discuss that there is a huge number of terms such as renovation, refurbishment, remodeling, reinstatement, retrofitting, conversion, transformation, rehabilitation, modernisation, re-living,

restoration, recycling and adaptive reuse itself, that are used to define adaptation activities. Therefore, there is an 'unhappy confusion' about these terms that first was noted by [Markus \(1979\)](#), and this confusion still exists ([Wilkinson et al., 2014](#)). The decision to select the synonyms of adaptive reuse was made based on the authors' knowledge in this field. The key terms were limited into two sections, the first section dedicated to "adaptive reuse" OR "adapt*" OR "conversion" OR "renovation" OR "transformation" (see [Table 1](#)) and due to the fact that we can find these words easily in many different fields, the second section of terms was added by "AND" to retrieve the data closer to the field of architecture, heritage and real estate, namely "built heritage" OR "historic* building" OR "architectural heritage" (see [Fig. 1](#)). As the term 'heritage' encompasses a wide range of elements, ranging from tangible entities like buildings and monuments to intangible aspects such as languages and songs ([Harrison, 2013](#)) and to specifically address the physical aspect, we have incorporated the qualifier "built" and "architectural" before it. While the primary focus of this study is on historic buildings, we also acknowledge the inclusion of buildings with cultural or social significance, which fall within the category of (built) heritage.

Some definitions of the keywords we used for the first stage in our literature selection process, show overlaps but also key differences. A significant disparity lies in the definitions if 'change of use' is a key aspect or not. Following [Wong \(2016\)](#), change of use is at the heart of adaptive reuse practice that gives new purpose to an unused or underutilized structure ([Wong, 2016](#)). Although during the review process, the authors tried to not exclude and involve all the papers regards to the adaptive reuse of (heritage) buildings but adaptive reuse or any adaptation activity in this research preferentially encompasses the change of function on a small or large scale.

2.1. Paper selection process

The number of papers identified based on the combination of key words was 882 in both Scopus and Web of Science. 151 papers were duplicates and removed, so the number of papers before starting the review process became 731. By carefully examining the titles and abstracts of these 731 papers, 220 papers were chosen for a comprehensive

Table 1
Definitions of key words.

Key word	Definition
Adaptive reuse	Adaptive reuse is based on the words 'adaptation' and 'reuse'. The term refers explicitly to changes that involve both a functional and a physical component. The change in function does necessarily mean a radical change, but it can be more subtle (Plevoets & Clempoe, 2019).
Adapt*	Adaptation is a process that includes alteration and addition (ICOMOS, 2010). Any work on a building over and above maintenance for changing its capacity and function is called adaptation (Douglas, 2006).
Conversion	Building conversion is the strategy of adapting abandoned and obsolete buildings that do not satisfy their users or are not used anymore by changing their function (Purwantiasning, Mauliani, & Aqli, 2013). Conversion literally means to convert or change from one use to another, an example of converting a barn to a residential property (Wilkinson et al., 2014)
Renovation	Renovation is defined by Douglas (2006) as "upgrading and repairing an old building to an acceptable condition, which may include works of conversion." The process of replacing the outdated components and layers or remodeling the interior spatial layout of existing buildings for development (Jensen & Maslesa, 2015; Ástmarsson, Jensen, & Maslesa, 2013).
Transformation	Adaptive reuse is referred to "transforming an unused or underused building into one that serves a new use" and its importance includes not only the reuse of existing structures but also the reuse of materials, transformative interventions, continuation of cultural phenomena through built infrastructure, connections across the fabric of time and space and maintaining memories (Wong, 2016).

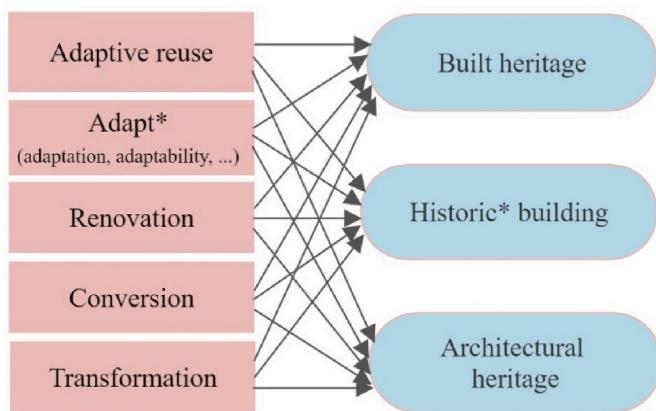


Fig. 1. Inclusion criteria, entered key words.

review of their entire contents. Following a thorough scanning process of these 220 papers, 72 were included in the final selection (Fig. 2). These selected papers mention success factors (or synonyms of that) explicitly or implicitly, ranging from a few words or more comprehensive sentences, to complete case studies or theoretical studies.

The screening process of 731 papers initially involved assessing the titles and abstracts for each paper consecutively. As the definition of the success of heritage adaptive reuse varies across studies and may be interpreted differently in different papers, thoroughly screening the abstracts was crucial in ensuring a comprehensive analysis for the final study. Even in cases where the terms "success of adaptive reuse" or "success factors" were not explicitly mentioned in the titles or abstracts, but there were closely related key words and terms to the success factors/criteria, success of adaptive reuse projects or decision-making criteria. In other words, the abstracts that contained words such as: "success/successful", "sustainability", "efficient/efficiency", "suitable" and terms like: "positive impacts/influences/results/factors", "development criteria", "sustainable renovation/development", "decision making criteria", "well-implemented reuse", "performance criteria", "transformative impacts", "adaptive reuse performance parameters" were chosen for the full text review. Consequently, a total of 220 papers were selected for a comprehensive review of their full text content.

In the final step, the full texts of the selected papers were reviewed to identify and elucidate the success factors of adaptive reuse projects through a thorough analysis. A physical document of these 220 papers' titles with their authors name(s) was listed to organise the data and find

the eligible papers and cross out the inapplicable ones. During the eligibility phase, the first step involved excluding literature related to the scale of urbanism or cities, as well as regional or land zone planning. This narrowing down of sources helped to obtain relevant materials specifically aligned with the research scope. Afterwards, papers pertaining to specific quantitative fields, such as technical studies, energy analysis, seismology, thermal or acoustic calculations, as well as specialist research areas containing irrelevant details to the field of study (e.g., archaeology, museology, psychological or social sciences), were omitted. Subsequently, papers that included (a) specific case studies with excessive details and irrelevant information about the property locations, political situations, or unique cultural traits that could not support the study were excluded from consideration. Furthermore, papers that exclusively concentrated on a specific country, city, or neighbourhood and presented data that were not applicable to the purpose of the paper or relevant to the classification of success factors were also excluded. However, a number of papers that represented case studies, were identified, from which this research could extract valuable insights. These papers are included in the list of references, and a select few will be discussed in greater detail later in the study. This step aimed to ensure that the remaining papers had a more generalizable and applicable nature to the research context. Taking into account all these considerations, from the initial 220 papers, 72 papers were selected for the evaluation of the final results. These 72 papers were scrutinised and the pertinent contents were highlighted in the format of pdf files to recover and structure data for the ultimate purpose of the study. The systematic literature review conducted in this study is acknowledged as a time-consuming methodology due to the extensive scope of research it encompasses, the uncertainty of terminology, involving both measurable and non-measurable contents. The four steps of the methodology were carried out by a single researcher, ensuring consistency throughout the process. To enhance the reliability of the final results, the layout and findings were subsequently reviewed by two other experts in the field. The final results, originating from distinct groups, were segregated and subsequently classified into ten categories of success factors by the authors. These categorizations include architectural (physical), structural (technical), socio-cultural, economic, environmental, energy, authenticity, legal, management (decision-making), and functional factors. Each category will be further discussed in detail below to provide a comprehensive understanding of the identified success factors.

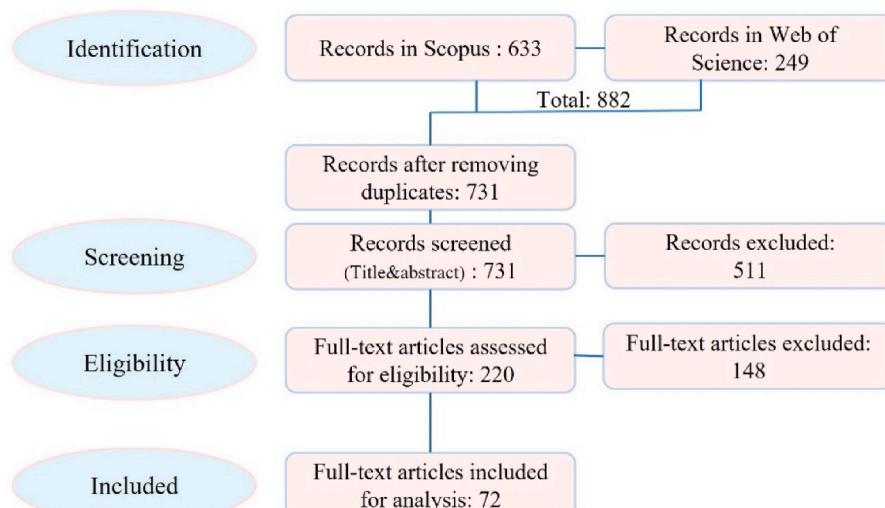


Fig. 2. PRISMA flow diagram for inclusion of the articles during the review process.

3. Results

3.1. Architectural (physical) factors

Reviving existing buildings through an adaptive reuse approach provides the opportunity to make the total built environment productive and aesthetically pleasing (Bullen & Love, 2011). Due to the importance of architectural historic features, minimum intervention and paying noticeable attention to define the suitable level of changes for conserving the character of heritage buildings is essential (Conejos et al., 2016; Djebbour & Biara, 2019; Douglas, 2006; ICOMOS, 2000; Langston, 2011). Materials are inseparably part of the historic character of heritage buildings, therefore “age value”, aesthetic qualities and pure beauty in the decay of them have to be on the priority list of reuse projects (Douglas-Jones, Hughes, Jones, & Yarrow, 2016; Holtorf, 2013; Lowenthal, 1985; Riegl, 1982). Besides, there should be a meaningful harmony for the visual compatibility between the original features of the heritage buildings and newly added components (Douglas, 2006; Elkerdany, 2002; Joudifar & Olgaç Türker, 2020). During the reuse process, the new architectural style should not falsify the old version of the building, the changes have to be recognisable (Barranca, Caldas, & Silva, 2017; Djebbour & Biara, 2019; ICOMOS, 1964; Lombardi, Pratali Maffei, Rossato, & Ifko, 2015; Matero, 2006) and moreover reversible for future adaptations (Besana, Greco, & Morandotti, 2018; Douglas, 2006; ICOMOS, 2003; Pickard, 1996; Shehata, Moustafa, Sherif, & Botros, 2015). The adapted reuse project should play a role as a catalyst for the urban upgrading of its neighbourhood and the improvement in physical characteristics of the buildings around it (Atash, 1993; Douglas, 2006; Jonas, 2006; Yung & Chan, 2012a). In any building project, creativity serves as a crucial parameter. However, when dealing with (heritage) existing buildings and aiming to respect their current circumstances, creativity becomes especially significant in successfully integrating old and new materials and innovation to fit the contemporary needs into the existing building (Aigwi, Egbelakin, & Ingham, 2018; Bullen, 2007; Dyson et al., 2016; Hill, 2016). (See Table 2)

3.2. Structural (technical) factors

In terms of structural aspects, historic buildings often do not conform to current regulations as contemporary buildings do. Therefore, it becomes imperative to upgrade the structural elements of historic buildings to attain an appropriate safety level for users and people around. Actions that should be taken into account are for example prediction of structural stresses from seismic movement (Aigwi, Ingham, Phipps, & Filippova, 2020; Bellico, 2011; Bruneau et al., 2003), technical improvements of the load-bearing structure and building envelope (Aigwi et al., 2018; Douglas, 2006; Highfield & Gorse, 2009), incorporating renewable technologies to improve indoor environmental conditions (Burns, 2014; Conejos et al., 2017; De Berardinis et al., 2017; Muñoz González, León Rodríguez, Suárez Medina, & Ruiz Jaramillo, 2020; Stival et al., 2020), etc. to improve the technical/structural condition of the historic or existing building for well implemented adaptive reuse. It is important to acknowledge that when dealing with historic buildings of heritage value, it is necessary to assess the potential impact of the new technical system on artworks and materials for developing suitable preservation strategies is required (Burns, 2014; Muñoz González et al., 2020; Stival et al., 2020). (see Table 3)

3.3. Socio-cultural factors

People around the world are proud of their history, civilisation and built heritage. Built heritage preservation and reuse of them enhance people's sense of connection to their local surrounding environments, public image, the feeling of belonging, attachment to the place (Abdullah et al., 2017; Aigwi et al., 2020; Alnafesi, 2013; Bullen & Love, 2011; Douglas, 2006; Misirlisoy & Günce, 2016a; Nasser, 2003;

Table 2
Architectural (physical) factors.

	Factor	Definition	References	Num
Architectural - Physical	Minimum intervention	Minimum intervention, defining suitable changing level. Considering the basic structure and character of the building to be intact	(DEH, 2004; Douglas, 2006; ICOMOS, 2000; The Charter of Krakow, 2000) (The Secretary of the Interior's Standards for Rehabilitation, 2006; Theologidou, 2007; Langston, 2011; Yung & Chan, 2012a; Philokyprou, 2014; Dyson et al., 2016; Conejos et al., 2016; Conejos et al., 2017; Sjöholm, 2017; Barranca et al., 2017; Chen, Chiu, & Tsai, 2018; Othman & Elsaay, 2018; Lah, 2019; Lo Faro & Miceli, 2019; Nesticò & Somma, 2019; Djebbour & Biara, 2019; Djebbour & Biara, 2020)	[21]
	Potential of reversibility	The new installations should not needlessly damage the building nor limit future adaptations	(Barranca et al., 2017; Besana et al., 2018; Conejos et al., 2016; Conejos et al., 2017; Douglas, 2006; Giuliani et al., 2018; Günce & Misirlisoy, 2014; ICOMOS, 1964; ICOMOS, 2003; Lombardi et al., 2015; Philokyprou, 2014; Pickard, 1996; Shehata et al., 2015) (Djebbour & Biara, 2019) (De Gregorio, De Vita, De Berardinis, Palmero, & Risdonne, 2020; Djebbour & Biara, 2020; Lo Faro & Miceli, 2019; Md Ali, Zawawi, Myeda, & Mohamad, 2019; Stival, Berto, Morano, & Rosato, 2020)	[19]
	Explicitness of alterations	The architectural style after reuse should not falsify the record of the past and new changes should	(Elkerdany, 2002; ICOMOS, 1964; ICOMOS, 2004; Matero, 2006) (The Secretary of the	[15]

(continued on next page)

Table 2 (continued)

Factor	Definition	References	Num	
Architectural harmony & Visual compatibility	be distinguishable for future generations	Interior's Standards for Rehabilitation, 2006; Torres, 2009; Güne & Misirlisoy, 2014; Philokyprou, 2014; Lombardi et al., 2015; Shehata et al., 2015; Barranca et al., 2017; Djebbour & Biara, 2019; Lah, 2019; Md Ali et al., 2019; Stival et al., 2020) (Douglas, 2006; Elkerdany, 2002; UNESCO, 1972) (The Secretary of the Interior's Standards for Rehabilitation, 2006; Torres, 2009; Andani, Rostro, & Sertyesilisik, 2013; Philokyprou, 2014; Conejos et al., 2017; Abdullah, Basha, & Soomro, 2017; Othman & Elsaay, 2018; Md Ali et al., 2019; Djebbour & Biara, 2019; Lynch & Proverbs, 2020; Lah, 2019; Djebbour & Biara, 2020; Joudifar & Olgaç Türker, 2020)	[16]	
Analysis and assessment of structural layout	The structural alterations to old buildings should be analysed/ assessed by expert consultants for conversion, level of intervention, safety indicators, and historical building envelope (integration, insertion, addition, etc.)	(Hickey, 2005; Douglas, 2006; Itard & Klunder, 2007; Architectural Institute of Japan, 2007; Barrett, 2009; Gibson, 2009; De Berardinis & Rotilio, 2009; Suratkon & Ando, 2010; Plevoets & Van Cleempoel, 2011; Bullen & Love, 2011; Remoy & Wilkinson, 2012; Cramer & Breitling, 2007; Yildirim, 2012; Philokyprou, 2014; Dyson et al., 2016; Conejos et al., 2016; Wells & Lixinski, 2017; De Berardinis,	[24]	

Table 2 (continued)

Factor	Definition	References	Num
Upgrading physical characteristics around	The reuse project should contribute to the improvement of the physical characteristics of surrounding areas, acting as a catalyst for urban upgrading	Rotilio, & Capannolo, 2017; Conejos et al., 2017; Besana et al., 2018; Brooker & Stone, 2017; Aigwi et al., 2018; Mohd Abdullah, Suratkon, & Syed Mohamad, 2020; Stival et al., 2020) (Atash, 1993; Chen et al., 2018; Conejos et al., 2017; Douglas, 2006; Jonas, 2006; Lah, 2019; Yung & Chan, 2012a)	[7]
Creativity	The creativity of fitting the contemporary needs and concept of the past into what already exists in the building	(Aigwi et al., 2018; Bullen, 2007; Dyson et al., 2016; González Martínez, 2018; Hill, 2016; Lah, 2019)	[6]
Age value of materials	Considering the "Age Value" of materials and aesthetic qualities of harmony and beauty in decay, patina, disintegration	(Cassar, 2009; Douglas-Jones et al., 2016; Holtorf, 2013; Lowenthal, 1985; Rieg, 1982; Unnerbäck, 2000)	[6]
Building usability	The importance of suitable infrastructures of the building such as electricity, drainage, mechanical systems, space utilization, lighting, air quality, etc. for future changes	(Aigwi et al., 2018; Architectural Institute of Japan, 2007; Bullen, 2007; Bullen & Love, 2011; Elzeyadi, 2002; Filippi, 2015; Hickey, 2005; Hong & Chen, 2017; Langston et al., 2008; Lepel, 2006; Mohd Abdullah et al., 2020; Stival et al., 2020)	[12]
Material durability	The interior and exterior fabric is constructed with durable materials that could be retained for the building's future new use	(Bullen & Love, 2011; Conejos, Langston, & Smith, 2014; Conejos et al., 2017; Djebbour & Biara, 2019; Douglas, 2006; Lah, 2019; Shipley et al., 2006; Wilkinson, Kimberley, & Reed, 2009; Wilkinson et al., 2014; Wilkinson & Remoy, 2018)	[10]

Table 3
Structural (technical) factors.

Structural – Technical	Factor	Definition	References	Num
	Predicting seismic resilience	The structural stresses from seismic action must be less than the ability of the existing structure to absorb, seismic resilience in emergency situations	(Bruneau et al., 2003; Prime Ministerial Directive, 2007; Bellicos, 2011; Philokyprou, 2014; Aigwi et al., 2018; Aigwi et al., 2020)	[6]
	Extension in building's life	The reuse project has to extend the useful building's life	(Bullen, 2007; Bullen & Love, 2011; Burns, 2014; Conejos et al., 2013; DEH, 2004; Latham, 2000; Mansfield, 2002; Velthuis & Spennemann, 2007; Wilkinson et al., 2009) (Yung, Chan, & Xu, 2014) (Aigwi et al., 2018; Conejos et al., 2016; Conejos et al., 2017; Djebbour & Biara, 2019; Djebbour & Biara, 2020; Dyson et al., 2016; Fedorczak-Cisak et al., 2020; Ho & Hou, 2019; Ijla & Broström, 2015; Radziszewska-Zielina & Ślądowski, 2017; Sharifi & Farahinia, 2020) (Burns, 2014; Conejos et al., 2017; De Berardinis et al., 2017; Muñoz González et al., 2020; Stival et al., 2020)	[21]
	Renewable technologies	Incorporating renewable technologies to improve indoor environmental conditions	(Burns, 2014; Conejos et al., 2017; De Berardinis et al., 2017; Muñoz González et al., 2020; Stival et al., 2020)	[5]
	New technical systems & artworks	Determining the impact of the new technical system on artworks for developing suitable preservation strategies.	(Burns, 2014; De Berardinis et al., 2017) (Othman & Elsaay, 2018) (De Gregorio et al., 2020; Muñoz González et al., 2020; Stival et al., 2020)	[6]
	Load- bearing structure	Technical improvement of the load-bearing structure, building envelope	(Aigwi et al., 2018; Douglas, 2006; Highfield & Gorse, 2009)	[3]
	Choice of materials	The choice of materials and construction systems with the requirements of reversibility, recycling, and dynamism	(De Gregorio et al., 2020; Stival et al., 2020; Trizio, De Vita, Ruggieri, & Giannangeli, 2020)	[3]
	Technological innovations	The potential of the building for innovative construction finishes, consistent with current technical trends	(Bullen & Love, 2011; Burns, 2014; Conejos et al., 2016; Shipley et al., 2006; Wilkinson et al., 2009; Wilkinson & Remøy, 2018; Wilkinson et al., 2014)	[7]
	Orientation and solar access	The importance of building orientation for providing opportunities for passive solar strategies	(Bullen & Love, 2010; Bullen & Love, 2011; Burns, 2014; Conejos et al., 2014; Conejos et al., 2017; Lombardi et al., 2015; Shipley et al., 2006; Wilkinson et al., 2009; Wilkinson & Remøy, 2018; Wilkinson et al., 2014)	[10]
	Flexibility of components	The arrangements/components for the project that can support functional and physical alterations for future/ previous reuse.	(Bullen & Love, 2010; Conejos et al., 2014; Conejos et al., 2017; De Gregorio et al., 2020; Lepel, 2006; Mohd Abdullah et al., 2020; Philokyprou, 2014; Shen & Langston, 2010; Shipley et al., 2006; Stival et al., 2020; Yildirim & Turan, 2012)	[11]

Pendlebury, Townshend, & Gilroy, 2004; UNESCO, 2007, pp. 2000–2004; Yildirim, 2012). A successfully adapted historical building should serve as a means to connect people with their cultural backgrounds, which brings a collective cultural identity and remembrance of the past to their life (Butina-Watson & Bentley, 2007). There are some important signs of socio-culturally well-developed heritage buildings that have been mentioned more often in literature. Adaptive reuse must consider the needs and desires of the community and its users (Pearson & Sullivan, 1995; Yildirim & Turan, 2012; Giuliani et al., 2018; Sharifi & Farahinia, 2020; De Gregorio et al., 2020). Moreover, Hill (2016) explained that a socially adaptive reuse project has to preserve the character of an area, improve the quality of public areas and create a sense of place. Older buildings are frequently associated with intrinsic social benefits and play a crucial role in maintaining the attractiveness of the streetscape, adding character to neighbourhoods and providing an appealing image to the community by means of representing highly crafted elements and materials (Langston et al., 2008). Besides, there is a relationship between the reuse of (vacant) heritage buildings and the safety of the communities. Conversion of vacant heritage buildings to adapted reuse buildings not only improves the image quality of the city but also has a considerable positive impact on the decline of criminal activities, anti-social norms, vandalism, and increasing community cohesion (Hill, 2016; Remøy & Wilkinson, 2012; Sharifi & Farahinia, 2020). Raising awareness of local people and promoting educational programmes (Al-hagla, 2010; Conejos et al., 2016; Djebbour & Biara, 2020; Hou & Wu, 2020; Zielina et al., 2017) about the heritage value and the benefits of preserving them and in the next step, community participation in decision making, planning and implementation of reuse projects (Cantacuzino, 1990; Yung et al., 2014; Lombardi et al., 2015; Hill, 2016; Ho & Hou, 2019) to comprehend their desires and needs can make a big contribution to the socio-culturally success of reuse projects. (see Table 4)

3.4. Economic factors

From an economic perspective, the factor of time holds significant importance in the construction process. In many cases, an adaptive reuse project can be accomplished within a shorter timeframe compared to the process of demolition and new construction. A shorter time period of redevelopment in adaptive reuse projects reduces the effect of inflation on construction costs, which has to be considered in decision-making (Ijla & Broström, 2015). Furthermore, an economic argument which is discussed by Highfield and Gorse (2009) & Douglas (2006) is that adapting a building is often cheaper than demolishing and building new. According to (Aigwi et al., 2018; Bullen & Love, 2011; Douglas, 2006; Langston et al., 2008; Shipley et al., 2006) the cost of converting a building is generally lower than new construction because many of the building elements and materials already are available on the site. Reusing existing buildings shows a saving of between 10 and 12 percent compared to constructing a new building. However, where original buildings are complex or need special requirements due to listing or registration, costs are likely to be higher than new build (Holyoake & Watt, 2002).

Several studies (Aigwi et al., 2018; Bullen & Love, 2011; Douglas, 2006; Langston et al., 2008) have confirmed the added value to existing properties that can be achieved through successful adaptive reuse approaches. In other words, the added value is not just limited to the historic building, but also spreads to the surrounding neighbourhoods. Undoubtedly, the importance of attractive location with good topography is undeniable for the economic success of reuse projects (Aigwi et al., 2020; Shipley et al., 2006; Yung & Chan, 2012a). Furthermore, increasing in job opportunities (Cantacuzino, 1990; Bianca, 2004; Boussaa, 2010; Yung & Chan, 2012a; Hill, 2016), earning from the tourism industry (Hong & Chen, 2017; Hou & Wu, 2020; Ren, 2011; Smith, 1988), self-sustaining through a potential market of new use (Murtagh, 2006; UNESCO, 2007, pp. 2000–2004; Yung et al., 2014) and at the end benefits of the project outweigh the costs of reuse (Murtagh, 2006; Shipley et al., 2006; Yung et al., 2014), also contribute to

Table 4
Socio-cultural factors.

Socio Cultural	Factor	Definition	References	Num
	Shared cultural identity	The shared cultural identity of the place/building due to the potential feature that it has	(Aigwi et al., 2018; Aigwi et al., 2020; Butina-Watson & Bentley, 2007; Elsorady, 2014; Ho & Hou, 2019; Murtagh, 2006; Tunbridge & Ashworth, 1996; Tweed & Sutherland, 2007; Yung & Chan, 2012a)	[9]
	Attachment and sense to place	The capability of the building to promote a feeling of belonging, the place attachment, community pride and connection with public image	(Alnafeesi, 2013; Bullen & Love, 2011; Douglas, 2006; Lowenthal & Binney, 1981; Nasser, 2003; Pendlebury et al., 2004; Stubbs, 2004; UNESCO, 2007, pp. 2000–2004; Yildirim, 2012; Yung & Chan, 2012a) (Hill, 2016) (Misirlisoy & Günce, 2016a; Abdullah et al., 2017; Aigwi et al., 2018; Besana et al., 2018; Djebbour & Biara, 2019; Ho & Hou, 2019; Lo Faro & Miceli, 2019; Wanner & Pröbstl-Haider, 2020; Aigwi et al., 2020; Mohd Abdullah et al., 2020; Kee & Chau, 2020)	[22]
	Maintaining the heritage and cultural significance	The capability of the heritage building and new use for the contribution of place's cultural significance and history	(Aigwi et al., 2018; Aigwi et al., 2020; Bullen & Love, 2011; Chen et al., 2018; Conejos et al., 2017; Elsorady, 2014; ICOMOS, 2013; Langston et al., 2008; Murtagh, 2006; Nasser, 2003; NSW and RAI, 2008; Philokyprou, 2014; Theologidou, 2007; Yung & Chan, 2012a; Yung et al., 2014)	[15]
	The interest of the community	The importance of attracting the public's interest to the refurbishment of historical buildings through a culturally programmed reuse	(Aigwi et al., 2018; Aigwi et al., 2020; Burns, 2014; Chen et al., 2018; Giuliani et al., 2018; Hill, 2016; Mohd Abdullah et al., 2020; Misirlisoy & Günce, 2016a; Nasser, 2003; Remøy, Voordt, & Van Der, 2007; Suratkon & Ando, 2010; Wang & Zeng, 2010; Wilkinson et al., 2009; Wilkinson & Remøy, 2018; Wilkinson et al., 2014)	[15]
7	Practical social amenity	The capability of the project to play a role as a practical social amenity in the neighbourhood, adding new elements	(Murtagh, 2006; Yildirim & Turan, 2012; Yung & Chan, 2012a; Elsorady, 2014; Conejos et al., 2014; Conejos et al., 2017; Aigwi et al., 2018, 2020; Hou & Wu, 2020; De Gregorio et al., 2020)	[10]
	The quality of life, and user's need	The reuse project has to improve the quality of people's daily life in the area and answer the user's needs	(Abdullah et al., 2017; Aigwi et al., 2018; Barranha et al., 2017; Besana et al., 2018; Bianca, 2004; Boussaa, 2010; Council of Europe, 1976; De Berardinis & Rotilio, 2009; De Gregorio et al., 2020; Djebbour & Biara, 2019; Gigliarelli, Porfyriou, & Corcella, 2014; Giuliani et al., 2018; Joudifar & Olgaç Türker, 2020; Kincaid, 2002; Lo Faro & Miceli, 2019; Maskey, Brown, & Lin, 2009; Nesticò & Somma, 2019; Phillips & Budruk, 2010; Philokyprou, 2014; Shehata et al., 2015; Yildirim & Turan, 2012; Yung et al., 2014)	[22]
	Community participation in reuse	Active community participation in the planning, and implementation of reuse projects is one of the best ways to understand community values, needs, and desires	(Cantacuzino, 1990; Ouf, 1995; Etyice, 2010; UNESCO, 2011; Dina & Maignan, 2012; Al-Ibrashy, 2012; Conejos et al., 2014; Den, 2014) (Yung et al., 2014) (Chen et al., 2018; Conejos et al., 2017; Djebbour & Biara, 2019; González Martínez, 2018; Hill, 2016; Ho & Hou, 2019; Joudifar & Olgaç Türker, 2020; Kee & Chau, 2020; Lo Faro & Miceli, 2019; Lombardi et al., 2015; Morrison & Waterson, 2019; Nesticò & Somma, 2019; Othman & Elsaay, 2018; Shehata et al., 2015; UNESCO, 2015; Wells & Lixinski, 2017) [25]	[25]
	Raising public awareness	Planning Interpretive programs such as publications, lectures, on-site info, and illustration to raise awareness of local residents, tourists, and the general public about reuse project/educational value	(Al-hagla, 2010; Astill, 2000; Chen et al., 2018; Conejos et al., 2016; Djebbour & Biara, 2020; Ho & Hou, 2019; Hou & Wu, 2020; Lah, 2019)	[8]
	Social inclusion	Social cohesion and combat social exclusion and issues; poverty, criminal activities, gentrification	(Feilden & Jokilehto, 1998; Remøy et al., 2007; Suratkon & Ando, 2010; Tweed & Sutherland, 2007; Yung and Chan, 2011, 2012b) (Yung et al., 2014) (Aigwi et al., 2018; Chen et al., 2018; Hill, 2016; Mohd Abdullah et al., 2020)	[11]

economically successful adaptive reuse projects. (see Table 5)

3.5. Environmental factors

In this research, the environmental factors pertain to the surrounding environment of the reused project and the relationship between the heritage building and its surroundings. One of the most repetitive factors in literature is “accessibility” to the building and within its spaces (Astill, 2000; Conejos et al., 2014; Barranca et al., 2017; Lynch & Proverbs, 2020). Buildings are kept alive by people and the relation between people and the environment of the historic district is a remarkable parameter (Aigwi et al., 2018; Dale & Newman, 2009; DEH, 2004; Van Kamp, Leidelmeijer, Marsman, & de Hollander, 2003; Yung & Chan, 2012a). Considering the environmental quality through the utilization of open and green spaces (Lombardi et al., 2015; Kiran Cakir et al., 2020), participating in urban regeneration plans and benefits (Langston, 2008; Hill, 2016; Djebbour & Biara, 2019), paying attention to the local contexts (landscape, setting, views) (Hickey, 2005; Remøy et al., 2007; Wang & Zeng, 2010) are some of the other environmental factors that can be found in the table of results. (see Table 6)

3.6. Energy factors

Adaptive reuse brings significant benefits for energy efficiency and the creation of a sustainable built environment through utilising existing buildings. Analysing the current condition of the building for energy efficiency and accordingly determining the level of restoration regarding the heritage value is an important early step that should be considered (Dyson et al., 2016; Franco, Magrini, Cartesegna, & Guerrini, 2015; Remøy & Wilkinson, 2012). Next, choosing adequate construction and energy efficient measures (Filippi, 2015; Güleroglu, Karagüler, Kahraman, & Umdu, 2020; Šekularac, Ivanović-Šekularac, Petrovski, Macut, & Radojević, 2020) is another significant action. The importance of building's envelope and applying maximum thermal protection measures to that (Ascione, Cheche, Masi, Minichiello, & Vanoli, 2015; Güleroglu et al., 2020; Passerini & Marchettini, 2018; Turanjanin, Vucicevic, & Jovanovic, 2016), maximising natural lighting and indoor air quality by design (Bullen & Love, 2010; Conejos et al., 2014; Shipley et al., 2006) are also mentioned here next to other factors for the energy efficiency of adaptive reuse projects. (see Table 7)

3.7. Authenticity& historic factors

The most successful adaptive reuse projects are those that respect and preserve a building's heritage significance as well as adding a new layer of contemporary architecture that provides value for the future (Bullen & Love, 2011; Djebbour & Biara, 2020; Misirlisoy & Gunce, 2016a; Theologidou, 2007). The core principles concerning the introduction of new uses in adaptive reuse projects can be summarized as follows: Firstly, the new use should have a minimal impact on the building's heritage significance and background (The Secretary of the Interior's Standards for Rehabilitation, 2006; Conejos et al., 2016), secondly, the new use should add a compatible and contemporary meaning that can provide value for future generations, thirdly, the new use should enhance the spirit of a place; and finally, it should conserve the culturally significant fabric of the building (Aigwi et al., 2020).

In general, the ultimate aim of maintaining heritage buildings is not to conserve material for its own sake but, rather, to maintain the values embodied by that heritage (Bridgland, 1995). Here it is important to understand what we call value: Douglas states that sometimes decay and weathering might be considered as “age value”, which shows the passage of time, authenticity and aesthetically pleasant character of the old building. On the other hand, he insists on avoiding artificially imitating (valued) forms of material transformation associated with aging (Douglas-Jones et al., 2016). Finally, as emphasized by Hill (2016), while deliverability and sustainability are essential considerations, it is crucial

Table 5
Economic factors.

Economic	Factor	Definition	References	Num
	Property value enhancement	Increase in property and land value after reuse	(Aigwi et al., 2018; Aigwi et al., 2020; Bullen & Love, 2010; Chen et al., 2018; Douglas, 2006; Engelhardt & Rogers, 2009; Haspel, 2011; Heath and Tiesdell, 2013; Kee & Chau, 2020; Lah, 2019; Lombardi et al., 2015; Misirlisoy & Gunce, 2016a; Misirlisoy and Gunce, 2016c; Othman & Elsaay, 2018; Shipley et al., 2006; Steinberg, 1996; Tweed & Sutherland, 2007; Wang & Zeng, 2010; Wanner & Probstl-Haider, 2020; Yiu & Leung, 2005; Yung et al., 2014)	[21]
	Saving construction cost	Saving costs from the reuse of construction materials	(Aigwi et al., 2018; Aigwi et al., 2020; Bullen & Love, 2010; Bullen & Love, 2011; Chen et al., 2018; Djebbour & Biara, 2019; Dyson et al., 2016; Heath and Tiesdell, 2013; Heritage Lottery Fund, 2009; Hong & Chen, 2017; Kohler & Yang, 2007; Langston et al., 2008; Shipley et al., 2006; Wilson, 2010; Yildirim, 2012; Yung & Chan, 2012a)	[16]
	Saving construction time	Saving time and shortening the construction period through the reuse of the existing structural elements	(Aigwi et al., 2018; Aigwi et al., 2020; Chen et al., 2018; Douglas, 2006; Hong & Chen, 2017; Johnson, 1996; Langston et al., 2008; Yung & Chan, 2012a)	[8]
	Attractive location	The attraction of the site/location with good topography, plot size, and scenery for tenants and buyers	(McCormick, 2002) (Shipley et al., 2006; Langston et al., 2008; Bullen & Love, 2010, 2011; Yung & Chan, 2012a; Aigwi et al., 2018, 2020; Lo Faro & Miceli, 2019)	[9]
	Increasing job opportunities	Increasing job opportunities, offering employment through the new function and to the local restores and craftsmen	(Cantacuzino, 1990; Bianca, 2004; Jonas, 2006; Langston et al., 2008; Tweed & Sutherland, 2007; Chan & Lee, 2008; Langston et al., 2008; Engelhardt &	[23]

(continued on next page)

Table 5 (continued)

	Rogers, 2009; Boussaa, 2010; Haspel, 2011; Yung & Chan, 2012a; Yung et al., 2014; Shehata et al., 2015; Dyson et al., 2016; Hill, 2016; Aigwi et al., 2018; Othman & Elsaay, 2018; Lah, 2019; Lo Faro & Miceli, 2019; Nesticò & Somma, 2019; Djebbour & Biara, 2019; Aigwi et al., 2020; Wanner & Pröbstl-Haider, 2020)	[20]
Earning from Tourism	Increasing financial gains in the area by earning from the tourism industry	(Smith, 1988; Tweed & Sutherland, 2007; Wilson, 2010; Haspel, 2011; Ren, 2011; Yung & Chan, 2012a; Alnafesi, 2013; Yung et al., 2014; Shehata et al., 2015; Misirlisoy & Gürne, 2016a; Misirlisoy and Gürne, 2016c; Hill, 2016; Hong & Chen, 2017; Aigwi et al., 2018; Joudifar & Olgaç Türk, 2020; Hon & Wu, 2020; Kee & Chau, 2020; Wanner & Pröbstl-Haider, 2020; Aigwi et al., 2020)
Return on investment	The tangible and intangible benefits of the project should outweigh the cost of rehabilitation.	(Aigwi et al., 2020; Murtagh, 2006; Shipley et al., 2006; Stival et al., 2020; Yung & Chan, 2012a; Yung et al., 2014)
Self-sustaining	The possibility of the historic building becoming self-sustaining if there is a potential market for the new use.	(Murtagh, 2006; Shipley et al., 2006; UNESCO, 2007, pp. 2000–2004; Remøy et al., 2007; Suratkon & Ando, 2010; Wang & Zeng, 2010; Yung et al., 2014; Misirlisoy and Gürne, 2016c; Aigwi et al., 2018; Chen et al., 2018; Mohd Abdullah et al., 2020)

to maintain the utmost respect for the heritage building and its cultural landscape. (see Table 8)

3.8. Legal factors

Legal factors are an inevitable aspect of adaptive reuse projects, as they encompass regulations and governmental limitations pertaining to building codes, fire issues of built heritage, legislation for providing a safe, healthy and friendly users project and etc (Aigwi et al., 2020; Bullen & Love, 2011; Conejos et al., 2014; Hong & Chen, 2017; Shehata et al., 2015; Wang & Zeng, 2010). National legislation and international agreements on preservation constitute additional legal factors in

Table 6
Environmental factors.

Environmental	Factor	Definition	References	Num
	Accessibility	The importance of transport facilities, easy access for vehicular and pedestrian movement in the building's location and urban accessibility	(ICOMOS, 2000; Astill, 2000; Talen, 2003; Douglas, 2006; Shipley et al., 2006; Wilkinson et al., 2009; Maskey et al., 2009; Bullen & Love, 2010; Phillips & Budruk, 2010; Bullen & Love, 2011) (Buildings Department of Hong Kong, 2012) (Abdullah et al., 2017; Aigwi et al., 2020; Barranca et al., 2017; Conejos et al., 2014; Lah, 2019; Lo Faro & Miceli, 2019; Lynch & Proverbs, 2020; Md Ali et al., 2019; Nesticò & Somma, 2019; Stival et al., 2020; Wilkinson & Remøy, 2018; Wilkinson et al., 2014)	[23]
	Liveability of the historic district	The adaptive reuse project has to contribute to the liveability (relation between environment and people) of the historic district	(The National Trust for Historic Preservation, 2002; Van Kamp et al., 2003; DEH, 2004; Dale & Newman, 2009; Yung & Chan, 2012a; ICOMOS, 2013; Shehata et al., 2015; De Berardinis et al., 2017; Aigwi et al., 2018; Kran Cakir et al., 2020)	[10]
	saving natural/local resources	Using local, high quality and durable materials, using renewable energy sources	(Feilden and Jokilehto, 1988; Heritage Lottery Fund, 2009; Meir, Garb, Jiao, & Cicelsky, 2009; Philokyprou, 2014; Lombardi et al., 2015; Shehata et al., 2015) (Hill, 2016) (Chen et al., 2018; De Gregorio et al., 2020; Lo Faro & Miceli, 2019)	[10]
	Participation in urban regeneration	Participating significantly in urban regeneration and	(Langston et al., 2008) (Hill, 2016) (Djebbour & Biara, 2019); (continued on next page)	[7]

Table 6 (continued)

Material life cycle	bringing benefits to that	Chen et al., 2018; Ho & Hou, 2019; Lah, 2019; Kiran Cakir et al., 2020)	
Using open and green spaces	Consideration of the environmental and consumer impact that specific materials have over the entire life cycle.	(Burns, 2014; Gigliarelli et al., 2014; Lo Faro & Miceli, 2019)	[3]
Scenic/contextual value	Increasing the environmental quality, and users satisfaction by using open and green spaces	(Lombardi et al., 2015; Kiran Cakir et al., 2020)	[2]

adaptive reuse practices, distinguishing them from new construction projects (Wilson, 2010; Lynch & Proverbs, 2020; Aigwi et al., 2020). The direct democratic governance by the local communities affected by urban development proposals, a political system of citizen partnership (WCED 1987; Chan & Yung, 2004; Lee and Chan 2008; Shipley, Jonas, & Kovacs, 2011; Yung et al., 2014) can help to manage regulations and legal barriers for developing more adaptive reuse projects. (see Table 9)

3.9. Management/decision-making factors

When making decisions regarding built heritage, it is important to consider various parameters. One crucial step in the decision-making process is to develop a heritage management plan after consulting with different stakeholders. This step plays a significant role in achieving the project's objectives (Jonas, 2006; Heritage Lottery Fund, 2009; Lombardi et al., 2015; Shehata et al., 2015; Misirlisoy and Gunce, 2016; Wanner & Pröbstl-Haider, 2020). An efficient partnership among the different stakeholders, or active stakeholder participation (Aas, Ladkin, & Fletcher, 2005; Astill, 2000; Djebbour & Biara, 2019; Ho & Hou, 2019; Samadi & Yunus, 2012), and also between stakeholders and locals, is one of the fundamental principles that have been discussed in theory and practice for the success of adaptive reuse approach. Following the principles of successful management in adaptive reuse approach, the stakeholders' benefits, interests, memory associations, experiences, and (new)use of place in making decisions must be considered (Bullen & Love, 2011; Dyson et al., 2016; Ho & Hou, 2019; Joudifar & Olgaç Türker, 2020).

Worthing and Bond (2008) emphasize the significance of effective management in ensuring the successful reuse of historical properties, as it plays a pivotal role in safeguarding and enhancing the historical environment (Yildirim, 2012). (see Table 10)

3.10. Functional factors

The success of an adaptive reuse project can be determined by the extent to which the new use is successful (Shehata et al., 2015).

Table 7
Energy factors.

Energy	Factor	Definition	References	Num
	Analysis of the current condition	Determining the type and level of (how) restoration according to the building value and making a thorough analysis of the current condition of the building for energy efficiency	(Akande, Odeleye, & Coday, 2014; Bullen & Love, 2011; De Berardinis et al., 2017; Dyson et al., 2016; Franco et al., 2015; Itard & Klunder, 2007; Ivanovic-Sekularac, Cikic-Tovarovic, & Sekularac, 2016a; Ivanović-Šekularac, Čikić-Tovarović, & Šekularac, 2016b; Martínez-Molina, Tort-Ausina, Cho, & Vivancos, 2016; Passerini & Marchettini, 2018; Remey & Wilkinson, 2012; Šekularac et al., 2020)	[12]
	Adequate construction/energy efficient measures	Selection of adequate construction and energy efficient measures for improving energy performance	(Filippi, 2015; Franco et al., 2015; Güleroglu et al., 2020; Lo Faro & Miceli, 2019; Šekularac et al., 2020)	[5]
	Establishing energy management	Establishing energy management at the site and making the correct choice of the method of obtaining total annual energy demands	(Ivanovic-Sekularac et al., 2016a; Šekularac et al., 2020)	[2]
	Applying energy efficient systems	In case possible, applying an energy efficient heating/cooling system, reduction in the thermal bridge, high quality windows, efficient air conditioning, etc.	(Ascione et al., 2015; Filippi, 2015; Güleroglu et al., 2020; Ivanovic-Sekularac et al., 2016a; Ivanović-Šekularac, et al., 2016b; Passerini & Marchettini, 2018)	[6]
	Thermal protection of envelop elements	The possibility of obtaining satisfactory energy saving by applying maximum thermal protection measures on the building envelop elements	(Burn, 2014; Akande et al., 2014; Ascione et al., 2015; Filippi, 2015; Lometbardi et al., 2015; Turanjanin et al., 2016; Ivanovic-Sekularac et al., 2016a; Ivanović-Šekularac, et al., 2016b; Passerini & Marchettini, 2018; Šekularac et al., 2020; Güleroglu et al., 2020)	[11]
	Reading of the building (Energy)	Consideration of a careful reading of the building to understand building layers, thermal bridge/zones, discover the "voids", etc.	(Filippi, 2015; Ivanovic-Sekularac et al., 2016a; Ivanović-Šekularac, et al., 2016b)	[3]
	The light & air quality	Maximising natural lighting and indoor air quality by design without	(Akande et al., 2014; Bullen & Love, 2010; Burns, 2014; Chen et al., 2018; Conejos et al., 2014; Conejos et al., 2014)	[10]

(continued on next page)

Table 7 (continued)

significant mechanical involvement	et al., 2017; De Berardinis et al., 2017; Ivanovic-Sekularac et al., 2016a; Lombardi et al., 2015; Shipley et al., 2006)
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Accordingly, the importance of a new function in adaptive reuse is undeniable. The new function has to be compatible with the original use (Abdullah et al., 2017; Aigwi et al., 2018; Aydin and Yaldiz, 2010; Ellison & Sayce, 2007; Elzeyadi, 2002; Philokyprou, 2014; Wilkinson et al., 2009). Furthermore, the compatibility between building and function is not only characterized by within or across-use function, also there should be a compatibility of new use with the original form and ancient character of heritage buildings (DEH, 2004; Bullen, 2007; Ijla & Broström, 2015; Misirlisoy & Günce, 2016b; Djebbour & Biara, 2019).

Buildings hold little meaning without people and it is vital to consider the engagement of users through the function of heritage buildings (Elzeyadi, 2002; Douglas, 2006; Yildirim, 2012; Shehata et al., 2015; Kiran Cakir et al., 2020) and defining new activities within these buildings to for their satisfactions, aspirations, and needs (Bullen & Love, 2011; Yildirim, 2012; Hong & Chen, 2017). (see Table 11)

4. Discussion

4.1. Sustainability, adaptive reuse and decision-making criteria

Sustainability is most commonly defined as 'meeting the needs of the present without compromising the ability of future generations to meet their own needs' (WCED, 1987). It is evident that adaptive reuse can benefit both the local community and also the existing built fabric. It encompasses positive attributes in socio-economic, ecological-environmental and cultural matters; these are considered to constitute the pillars of sustainability, therefore adaptive reuse potentially is part of this scope (Passerini & Marchettini, 2018). The careful selection of an appropriate approach in adaptive reuse can serve as a strong motivator in achieving a more sustainable built environment (Dyson et al., 2016). Furthermore, the reuse of existing buildings is widely regarded as one of the most impactful forms of sustainable design (Philokyprou, 2014). According to Djebbour and Biara (2020), building adaptation can be called successful if it considers the sustainability criteria. However, in this research, the success factors not only review the pillars of sustainability but also cover the wider spectrum of factors in other aspects. In other words, some of the success factors of adaptive reuse are often in parallel with the sustainability criteria and when a project is considered relatively successful, it is potentially sustainable too. Hence, in this study, the meaning of success extends beyond sustainability. It is important to highlight that the path to success not only involves meeting sustainability criteria but also aligning with the criteria and inputs of adaptive reuse decision-making models. For instance, the adaptSTAR model as an approved adaptive reuse decision-making model provides a weighted checklist of some design strategies that can assist in the development of new projects, ensuring their potential for successful future reuse (Conejos, Langston, & Smith, 2015). This checklist is organised into seven categories: physical, economic, functional, technological, social, legal and political. Accordingly, Conejos et al. (2014) argued that "the higher the success of the adaptive reuse project, the higher the adaptSTAR score" and she verified her assumption in her research. Although ARP (Adaptive Reuse Potential) decision-making model unlike the adaptSTAR model, is applied later when the original purpose of the building is becoming obsolete but it also evaluates the potential of success as a percentage score within the same categories as the adaptSTAR model. As a result, there is a close relationship between the inputs of adaptive reuse decision-making models and the success

Table 8
Authenticity factors.

Authenticity	Factor	Definition	References	Num
	Aesthetic contribution to the historical streetscape	The existence of a building's aesthetic features to sustain the visual heritage appeal of the surrounding buildings	(Nasser, 2003; Bullen, 2007; Wilson, 2010; Bullen & Love, 2011; Yung & Chan, 2012a; Philokyprou, 2014; Abdullah et al., 2017; Aigwi et al., 2018, 2020; Chen et al., 2018)	[10]
Architectural history		The importance of the inherent fabric of the original building (features) and the materials for the sustainability of the architectural history/narration of towns	(The Venice Charter, 1964; Nasser, 2003; Douglas, 2006; ICOMOS, 2013; Philokyprou, 2014; Plevoets & Van Cleemput, 2014; Burns, 2014; Vakhitova, 2015; Misirlisoy & Günce, 2016a; Douglas-Jones et al., 2016; Chen et al., 2018; Aigwi et al., 2018; Lah, 2019; Ho & Hou, 2019; Md Ali et al., 2019; Stival et al., 2020; Lynch & Proverbs, 2020; Aigwi et al., 2020; Djebbour & Biara, 2020; Joudifar & Olgaç Türker, 2020; Sharifi & Farahinia, 2020)	[21]
	The importance of the historic site	The authenticity and integrity of historic sites are crucial	(Pearson & Sullivan, 1995; Sjöholm, 2017; UNESCO, 2012; UNESCO, 2015; Yildirim, 2012) (González Martínez, 2018) (Lo Faro & Miceli, 2019; Md Ali et al., 2019)	[8]
	Assessing the authenticity aspects	Assessing/preserving the aspects, characteristics and meanings of the heritage building as accumulated over time, vital sceneries	(Conejos et al., 2017; De Berardinis et al., 2017; De Gregorio et al., 2020; Dukanovic, 2017; ICOMOS, 2013; Lo Faro & Miceli, 2019; Martinez-Molina et al., 2016; Sjöholm, 2017; UNESCO, 2015)	[9]
	Reliability of the data	The reliability of the information sources about the value of the heritage building regarding the authenticity	(UNESCO, 2015; Sjöholm, 2017)	[2]
	Considering cultural diversity	Consideration of cultural diversity and its authenticity, the diversity of	(González Martínez, 2018; Lowenthal, 1995; Lowenthal & Binney, 1981)	[6]

(continued on next page)

Table 8 (continued)

Attention to valuable and fragile heritage features	ethnic, religious, less-favoured social groups and the diversity of scale During the adaptation process, it is important to take care of valuable/unique heritage features of the building which are fragile to damage or lost	(ICOMOS, 1964) (The Secretary of the Interior's Standards for Rehabilitation, 2006; Philokyprou, 2014; Lamprakos, 2015; Shehata et al., 2015; Barranha et al., 2017; Md Ali et al., 2019; Lah, 2019; Lo Faro & Miceli, 2019; Lynch & Proverbs, 2020)	[10]
Reflecting building's life in the past	Besides determining the history, it is also important to reflect the past events, the memory and story of the building, a matter of interpretation and translation, Categorisation of the parts of the building that are significant and those that may not be of great importance is required	(Barranha et al., 2017; González Martínez, 2018; Guttormsen & Fageraas, 2011; Hill, 2016; Joudifar & Olgac Türker, 2020; Lah, 2019; UNESCO, 2012)	[7]
Prioritizing the building's parts	(The Venice Charter, 1964; Brooker & Stone, 2017; Scott, 2008; Klingenberg, 2012; ICOMOS, 2013; Philokyprou, 2014; Plevaets & Van Cleempel, 2014)	[7]	

factors of adaptive reuse of (heritage) buildings in this research. Hence, the inclusion of literature that emphasizes input factors for decision-making is justifiable, as it aligns closely with the success factors identified in this research.

4.2. Success factors

In order to sort the success factors derived from the systematic literature review, there is a possibility to divide them into three main groups generally: first, the conceptual success factors which are related to the values of adaptive reuse projects namely socio-cultural and authenticity factors and the second category which is based on design or planning criteria and is called operational success factors including architectural-physical, structural-technical, decision-making, energy, economic and legal factors. However, in between there is a hybrid category that is not fully limited to the conceptual or operational divisions like functional and environmental factors. Within the functional factors, "Engagement of humans and heritage" can be considered conceptual, but "Defining temporary function at the early stage" seems to be operational. Moreover, in the environmental factors "Liveability of historic district" can be classified as a conceptual factor however "Using of open and green spaces" can be considered operational. Thus, the success path of adaptive reuse encompasses a combination of tangible and intangible elements, as well as operational and conceptual factors, qualitative and quantitative variables. This inherent complexity presents challenges in comparing and analyzing these factors comprehensively. Another issue arises from the interchangeable use of different jargon, not only between adaptive reuse and its synonyms but also

Table 9
Legal factors.

Legal	Factor	Definition	References	Num
	Compatibility with the building code requirements	Compatibility with the current building code and legislation for providing a safe, healthy and friendly users project, considering fire protection, emergency escape, access for disabled users, indoor air quality, etc.	(Langston et al., 2008; Wang & Zeng, 2010; Bullen & Love, 2011; Yung & Chan, 2012a; Conejos et al., 2014; Shehata et al., 2015; Lombardi et al., 2015; Conejos et al., 2016; Conejos et al., 2017; Hong & Chen, 2017; Aigwi et al., 2018; Giuliani et al., 2018; Besana et al., 2018; Md Ali et al., 2019) (Lo Faro & Miceli, 2019) (Aigwi et al., 2020)	[16]
	Respecting the preservation rules and provisions	Preserving the significant features with heritage value according to the international and national provisions	(Building Act, 2004; Suratkon & Ando, 2010; Bullen & Love, 2011; Wilson, 2010; Othman & Elsaay, 2018; Lynch & Proverbs, 2020; Aigwi et al., 2020; Mohd Abdullah et al., 2020)	[8]
	Compatibility with zoning and (urban)planning requirements	The reuse project should meet the current urban master plan, zoning and planning specification	(Mosetto & Vecco, 2001; De La Torre, 2002; Shipley et al., 2006; Wang & Zeng, 2010; Conejos et al., 2014; Conejos et al., 2017; Giuliani et al., 2018; Aigwi et al., 2018, 2020; Djebbour & Biara, 2019; Nesticò & Somma, 2019; Lo Faro & Miceli, 2019; Mohd Abdullah et al., 2020)	[13]
	Direct democratic governance	The importance of direct democratic governance by the local communities affected by urban development proposals, a political system of citizen partnership	(Chan & Lee, 2008; Chan & Yung, 2004; Chen et al., 2018; Eley & Worthington, 1984; ICOMOS, 1987; Shipley et al., 2011; United Nations Habitat, 2004; WCED, 1987; Wells & Lixinski, 2017; Yildirim & Turan, 2012; Yung et al., 2014)	[11]
	public-private partnerships	The important role of public-private partnerships as a fundamental element for the economic, social, and other success aspects of reuse	(Conejos et al., 2014; Giuliani et al., 2018; Lo Faro & Miceli, 2019; Yildirim & Turan, 2012)	[4]
	Research, Identification & Historic Analysis	Legitimising the decision by the identification of original architectural drawings, in-depth	(Aigwi et al., 2018; Douglas, 2006; Dyson et al., 2016; Giuliani et al., 2018; Ho & Hou, 2019; Joudifar &	[12]

(continued on next page)

Table 9 (continued)

knowledge about the building's construction and archival of information about the changes, minor changes, community approval	Olgaç Türker, 2020; Latham, 2016; Letellier, Schmid, & LeBlanc, 2007; Lo Faro & Miceli, 2019; Shehata et al., 2015; Sjöholm, 2017; Yıldırım, 2012
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within the group titles of success factors. For instance, during the review process, the authors faced multiple socio-cultural factors that could be listed in the authenticity section and the other way around. Due to their conceptual nature, it can be challenging to explicitly distinguish between these factors. Interestingly, both factors are highly cited as success factors, alongside the architectural-physical and economic factors from the operational categories. Based on this fact, it appears that the original building's layouts, its historical significance, the architecture of both the old and new sections, the socio-cultural impacts of reuse, and the economic justification and financial benefits are crucial factors that significantly influence the success of adaptive reuse projects. In the architectural (physical) table of results, "analysing and assessment of the structural layout of the old building" and among the energy factors "analysis of the current condition of the building for energy efficiency" are the most repeated factors in the literature and it represents the significance of analysing the current condition of the original building by the expert consultants for future changes at the early stage of decision-making process. "Extending the useful life of the building" is considerably on the top of the literature lists in the technical (structural) table. Regards to the socio-cultural factors "active community participation in the planning of reuse projects" is highly cited and it shows the importance of people's participation during the decision-making process. Relating to the economic success of adaptive reuse projects "increasing

in property value" is the significant indicator of success, which is "accessibility" to the building and within the building in the environmental category. In order to achieve authenticity success in reuse projects, significant attention should be given to "Architectural history." This term refers to the intrinsic fabric of the original building, including materials, features, histories, narratives, and more, as indicated by numerous references. While among the legal factors "compatibility with the current building code and legislation" and "Compatibility with zoning and (urban)planning requirements" are in the top list of references. Proper decision-making is essential for the success of any project, particularly when dealing with heritage buildings. In the context of heritage buildings, detailed heritage management and the implementation of long-term protection measures are fundamental aspects of decision-making. The importance of these factors is further supported by the significant number of references mentioned earlier.

While this research primarily focuses on the adaptive reuse of heritage buildings, it is important to highlight that the factors identified can be applied to decision-making processes for adaptive reuse projects in general. But, it is evident that for the decision-making process of adaptive reuse of heritage buildings, more attention must be paid to authenticity, aesthetic, architectural and cultural factors as compared to adaptive reuse of other buildings. This research lists the most commonly discussed factors regardless of specific characteristics such as location, listed or non-listed buildings and particular cultural aspects, to assist the decision-makers in accomplishing more successful adaptive reuse projects.

4.3. Success in other literature

As mentioned in the methodology section, the inclusion of papers during the review procedure was not limited solely to those explicitly addressing the term "success." Several studies were considered that implicitly discussed success through alternative interpretations and diverse categorizations. As an example, [Yung and Chan \(2012a\)](#)

Table 10
Management (decision making) factors.

Management-Decision Making	Factor	Definition	References	Num
Making Decision (common) steps		1) Evaluating historical building 2) The need to classify them 3) Determining the financing priorities 4) Determining a variety of works on the historical structure	(Dutta & Husain, 2009; Skłodowski, Dytczak, & Szmelter, 2012; Turskis, Zavadskas, & Kutut, 2013; Vodopivec, Žarnić, Tamosaitienė, Lazauskas, & Šelih, 2014; Lah, 2019; Fedorczak-Cisak et al., 2020; De Gregorio et al., 2020)	[7]
Management conservation plan		Providing a detailed (heritage) management plan after consulting with the stakeholders, The application of long-term protection measures	(Chen et al., 2018; Conejos et al., 2016; Conejos et al., 2017; Djebbour & Biara, 2020; Heritage Lottery Fund, 2009; ICOMOS, 2013; Jonas, 2006; Lah, 2019; Lombardi et al., 2015; Misirlisoy and Günce, 2016; Shehata et al., 2015; Wanner & Pröbstl-Haider, 2020; Yıldırım, 2012; Yıldırım & Turan, 2012)	[14]
The "right" partnership of stakeholders		A successful reuse project depends on creating the "right" partnership between stakeholders to make the best decision	(Aas et al., 2005; Astill, 2000; Conejos et al., 2017; Dina & Maignan, 2012; Djebbour & Biara, 2019; Ho & Hou, 2019; Md Ali et al., 2019; Samadi & Yunus, 2012; Shehata et al., 2015) (Lah, 2019) (Joudifar & Olgaç Türker, 2020; Kee & Chau, 2020; Lo Faro & Miceli, 2019; Wanner & Pröbstl-Haider, 2020) (Butina-Watson & Bentley, 2007; Radziszewska-Zielina & Ślądowski, 2017)	[14]
Various knowledgeable experts Indispensable data for decision making		The requirement of supporting the decision by numerous knowledgeable experts from various fields within the construction industry Indispensable data for evaluating intervention correctness, material features, context integration, investment opportunities, respecting to the building (recognising tangible and intangible features), etc.	(Fedorczak-Cisak et al., 2019; Nesticò & Somma, 2019)	[2]
Recording the management process		Planning and recording a management scheme that contains the heritage fund sourcing and heritage agreements, documentation, etc.	(Conejos et al., 2014; Ho & Hou, 2019; ICOMOS, 2013; Letellier et al., 2007)	[4]
The needs in the region Stakeholders' satisfaction		Recognising the needs of the adaptive reuse region in decision-making can extend the life of the project For the success of reuse projects, the stakeholders' benefits, interests, memory association, experience, use of place in making decisions are necessary	(Djebbour & Biara, 2019; Giuliani et al., 2018; Joudifar & Olgaç Türker, 2020; Lah, 2019; Misirlisoy and Günce, 2016c) (Bullen & Love, 2011; Dyson et al., 2016; Ho & Hou, 2019; Joudifar & Olgaç Türker, 2020)	[5]
Management policies		The management policies should ascertain whether a particular use is compatible	(Pearson & Sullivan, 1995; Yıldırım & Turan, 2012)	[2]

Table 11
Functional factors.

Functional	Factor	Definition	References	Num
	The new functional compatibility with the old use	a new use compatible with the original one “across Use”. Also respecting the original use	(Abdullah et al., 2017; Dyson et al., 2016; Ellison & Sayce, 2007; Elzeyadi, 2002; Ouf, 1995; Philokyprou, 2014; Pickard, 1996; Radziszewska-Zielina & Śliadowski, 2017; Wang & Zeng, 2010; Wilkinson et al., 2009) (Intergovernmental Committee for the Protection of the World Cultural and Natural Heritage, 2008; Mohd Abdullah et al., 2020; ICOMOS, 2013; Yildirim & Turan, 2012; Yildirim, 2012; Yung & Chan, 2012a; Conejos et al., 2017; Aigwi et al., 2018; Lah, 2019; Lo Faro & Miceli, 2019)	[20]
	Compatibility of new use to the original building	The new use should respect the historic/ artistic character and ancient form of the heritage building as a priority	(ICOMOS, 1931; Ijla & Broström, 2015; Misirlisoy & Günç, 2016b; Djebbour & Biara, 2019; Bullen, 2007; DEH, 2004; Md Ali et al., 2019; Djebbour and Biara, 2020; Worthing & Bond, 2008; Yildirim & Turan, 2012; Shehata et al., 2015; Lo Faro & Miceli, 2019; Conejos et al., 2017)	[13]
	Engagement of humans and heritage building	The success of new use is usually who noticed the dynamic engagement of humans and the architectural heritage building	(Elzeyadi, 2002; Douglas, 2006; Kiran Cakir et al., 2020) (Yildirim, 2012) (Lo Faro & Miceli, 2019; Shehata et al., 2015)	[6]
	People's activities in new use	The importance of combining the needs relevant to the preferences and expectations of the new use, aspirations	(Bullen & Love, 2011; De Gregorio et al., 2020; Elzeyadi, 2002; Hong & Chen, 2017; Kiran Cakir et al., 2020; Yildirim, 2012)	[6]
	Usefulness of spaces	The new function has to use the different spaces of the original building perfectly	(Bullen & Love, 2011; Djebbour & Biara, 2019; Shipley et al., 2006)	[3]
	Temporary function	Defining temporary function at the beginning for reducing the expenses,	(Aigwi et al., 2018; Lah, 2019)	[2]

attributed success to sustainability by highlighting four key aspects: economic, socio-cultural, political, and environmental factors. [Othman and Elsaay \(2018\)](#) examined the efficacy of adaptive reuse in six domains, namely governmental, societal, economic, technical, legal, and environmental, with a specific focus on developing countries. [Chen et al. \(2018\)](#) presented a set of twenty criteria for the reuse of historic buildings, encompassing five aspects: economic, social, environmental, architectural, and historical. [Mohd Abdullah et al. \(2020\)](#) provided a definition of criteria aimed at facilitating the decision-making process for adapting heritage buildings. Their framework included six aspects: economic, social, technological, environmental, architectural, and legislative. [Aigwi et al. \(2020\)](#) categorized pertinent parameters within a performance-based framework, which serves as a guide for making decisions regarding adaptive reuse. This framework aims to achieve more effective and targeted outcomes in the decision-making process. In addition, there were several papers that specifically emphasized certain aspects of success factors. For instance, [Douglas-Jones et al. \(2016\)](#) primarily focused on the authenticity of historic buildings, age value, and aesthetic parameters. [Wells and Lixinski \(2017\)](#) concentrated on the legal aspects of adaptive reuse, while [Shipley et al. \(2006\)](#) centered their study on economic parameters and investment. [Franco et al. \(2015\)](#) examined energy efficiency and production, while [Kiran Cakir et al. \(2020\)](#) highlighted the significance of open green spaces in reused buildings. [Bellicoso \(2011\)](#) explored building regulations and anti-seismic legislation. [Abdullah et al. \(2017\)](#) delved into the socio-cultural sustainability and viability of adaptive reuse. [Plevoets and Van Clempel \(2014\)](#) specifically investigated interior features and the approach to adaptive reuse. Furthermore, among the final results, a number of papers did not explicitly classify success factors throughout the text. Instead, the authors conveyed their knowledge and understanding of the success of adaptive reuse through the analysis of one or more case studies. For instance, [Burns \(2014\)](#) examined the conversion process of a project from a hotel to an office building, emphasizing the importance of striking a proper balance between historic preservation and sustainable project requirements. [Philokyprou \(2014\)](#) discussed the reuse of several listed buildings for university purposes, highlighting the numerous benefits brought to the old town. The author demonstrated a clear awareness of a wide range of success factors that should be taken into account during the reuse process. In another study, [Hou and Wu \(2020\)](#) explored the management process and key characteristics of heritage building revitalization using a case study conducted in Hong Kong. Additionally, [De Gregorio et al. \(2020\)](#) showcased the positive impacts of adaptive reuse on the community, environment, and local economy through a case study analysis. This study aimed to incorporate all the aforementioned information without overlooking the potential benefits each of them offers.

5. Conclusion

This paper aimed to answer the question “What are the factors that can be used to assess the success of heritage adaptive reuse projects?”. Accordingly, this research recognised, classified and analysed the success factors of adaptive reuse of heritage buildings by a systematic literature review of recent literature from Web of Science and Scopus Databases. The results were listed into ten categorisations: architectural (physical), structural (technical), socio-cultural, economic, environmental, energy, authenticity, legal, management (decision-making) and functional factors.

This research found that if an adaptive reuse project falls into the scope of sustainability, it is potentially successful too but it does not necessarily work the other way around, as the success factors cover a wider spectrum of contents than the three main pillars of sustainability. On the other hand, this research argued that there is a close relationship between the inputs of adaptive reuse decision-making models and the success factors of adaptive reuse of (heritage) buildings. In general, the success factors of adaptive reuse projects can be conceptual, operational

or hybrid and according to the list of references, the conceptual success factors (socio-cultural and authenticity) are two categorizations of the most cited factors in the literature. Furthermore, the architectural-physical and economic factors from the operational categories are also on the top list of references. Therefore, the original building's layouts, the history behind that, the architecture of the old and new parts, the socio-cultural impacts of reuse and the economic justification and financial benefits play vital roles in the success of adaptive reuse projects.

The structured results of this research can facilitate the decision-making process of adaptive reuse projects and help the stakeholders and decision-makers to consider which factors should be considered for better adaptive reuse projects.

Further research will focus on evaluating the theoretical success factors that were revealed in this study in real cases and in practice. Assessment of the case studies by means of the success factors and the combination of the theoretical and practical data can help to step forward to the consolidation of a framework to raise the success level of decision-making in adaptive reuse of heritage buildings.

Author statement

Fatemeh Vafaie: Reading and Reviewing as the first author for the systematic review, Original draft preparation.

Hilde Remoy: Reviewing the results as the second author, Editing and writing the original draft, supervision.

Vincent Gruis: Reviewing the results as the third author, Editing and writing the original draft, supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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